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ELECTROMYOGRAPHY SIGNAL EVALUATION OF HUMAN RESPIRATORY MUSCLES FOR BREATHING ACTIVITY: TECHNICAL ANALYSIS

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1. INTRODUCTION

Breathing is one of the most important daily activities in human life. The mechanism of breathing aids in the transfer of oxygen from air into lungs where gas exchange takes place and facilitates in the removal of carbon dioxide gas out from body. Most tissues in our body require oxygen gas for metabolism purpose. As a result, carbon dioxide gas is produced as end product of metabolism. Therefore, breathing cycle is repeated continuously to bring in oxygen and eliminate carbon dioxide gas. Numerous researches had been done in investigating human breathing parameters and performances. Research in this particular area are of multiple purposes involving various disciplines such as studying effect of certain breathing techniques on Parkinson patients [1]; effect of aquatic cycling on respiratory responses [2]; association between lung function variables with asthma diagnosis [3] and comparing breathing parameters of different breathing techniques [4].

Measurements of human respiration provide parameters for breathing performance. Conventional human respiration assessment involves measurement of inflow and outflow of the breathing air. Spirometer is the most common tool for human respiration measurement, especially for diagnosis of respiratory-based diseases [5]. By performing pulmonary

function test using the spirometer, several respiration parameters can be derived. Among them are Forced Vital Capacity (FVC), Forced Expiratory Volume in one second (FEV1), Maximal Inspiratory Pressure (PImax) and Maximal Expiratory Pressure (Pemax) [6]. Apart from the parameters mentioned above, there is also another evaluation on human breathing characteristic i.e. through the assessment of respiratory muscles via data from electromyography (EMG) signal. Breathing mechanism involves the working of several muscles during human breathing activity. Most of these muscles are located around the chest such as intercostal muscles and diaphragm. These are the primary respiratory muscles that involves in chest movement for breathing.

On the other hand, there are also secondary respiratory muscles that provide minor contribution during human breathing. Among the actions that performed by respiratory muscles during breathing are rib cage elevation during inspiration, thoracic activity expansion and abdominal pressure increment.

2. RESEARCH BACKGROUND

Although there are many ways to find out the airflow measurement during breathing, but the optimize ways to acquire it is by using sensors and spirometer on subject's mouth to measure airflow. However, this approach might cause discomfort to subjects, which then might result in inaccurate data. Furthermore, a study of the inspiratory recruitment of the neck muscles using spirometer is clinically relevant, but the interpretation of breathing recordings is difficult due to inefficiency in measuring the contraction of muscles during breathing activity [6]. Thus, the objective of this work is to investigate the relationship between the EMG activities of respiratory